CLAIMS

What is claimed is:

1. A slotted electrophoresis gel composition comprising a primary gel comprising a first matrix with a sample loading zone and at least one preformed slot comprising an opening for a secondary gel comprising a second matrix, wherein said slot can have any geometric configuration within the primary gel.

2. The electrophoresis gel composition of Claim 1, wherein at least one preformed slot is aligned longitudinally to the longitudinal axis of the gel.

3. The electrophoresis gel composition of Claim 1, wherein at least one preformed slot is aligned perpendicular to the longitudinal axis of the gel.

4. The electrophoresis gel composition of Claim 1, wherein at least one preformed slot is aligned diagonally to the longitudinal axis of the gel.

5. The electrophoresis gel composition of Claim 1, wherein said first and second matrices are selected from the group consisting of: polyacrylamide, starch, agarose and combinations thereof.

6. The electrophoresis gel composition of Claim 5, wherein said first and second matrices are different.

7. The electrophoresis gel composition of Claim 1, wherein at least one preformed slot comprises a secondary gel comprising at least one immobilized molecular probe selected from the group consisting of: nucleic acids, modified nucleic

acids, nucleic acid analogs, antibody and antigen binding fragments thereof, protein, polypeptide and peptide.

8. An apparatus for producing a slotted electrophoresis gel composition comprising the following:

(a) at least one slot-forming comb, wherein said slot-forming comb is comprised of at least one slot-forming element;

(b) two plates that serve to constrain the electrophoresis medium when in the liquid phase;

(c) at least one spacer that is positioned between the two plates of (b), and

(d) at least two clamps that secure the two plates of (c) together.

9. A method of detecting the presence, or absence, of one, or more, target molecules in a biological sample using the gel composition of Claim 1, comprising the following steps:

(a) immobilizing at least one probe within the secondary gel matrix of at least one slot in the primary gel composition;

(b) introducing the biological sample into the primary gel matrix;

(c) subjecting the electrophoresis gel composition to an electric field such that the target molecule(s) migrates into the secondary gel of at least one slot, wherein the secondary gel contains a probe specific for the target molecule and the target molecule interacts with the immobilized probe, thereby forming an immobilized probe complex, and

(d) detecting the presence of the target molecule/probe complex in the electrophoretic medium,

wherein the detection of at least one target molecule/probe complex is indicative of the presence of at least one target molecule in the biological sample.

10. The method of Claim 9, wherein said detection is selected from a group consisting of: radioactivity, luminescence, chemiluminescence, affinity-ligand, enzymatic and fluorescence.

11. The method of Claim 9, wherein said target molecule is selected from the group consisting of: proteins, polypeptides, carbohydrates, lipids, deoxyribonucleic acid, ribonucleic acid and combinations thereof.

12. The method of Claim 9, wherein said probe is selected from the group consisting of: nucleic acids, modified nucleic acids, nucleic acid analogs, antibody and antigen binding fragments thereof, protein, polypeptide and peptide.

13. A method of detecting the presence, or absence, of one, or more, target molecules in a biological sample using the gel composition of Claim 1, comprising the following steps:

(a) forming a secondary gel comprising matrix material different from that comprising the primary gel matrix in at least one slot located in the primary gel composition;

(b) introducing the biological sample into the primary gel matrix;

(c) subjecting the electrophoresis gel composition to an electric field such that the target molecule(s) migrates into the secondary gel of at least one slot, wherein the secondary gel contains a different matrix material from the primary gel composition and the target molecule's migration rate alters, and

(d) detecting the presence of the target molecule in the electrophoretic medium, wherein the detection of at least one target molecule is indicative of the presence of at least one target molecule in the biological sample.

14. The method of Claim 13, wherein said detection is selected from a group consisting of: radioactivity, luminescence, chemiluminescence, affinity-ligand, enzymatic and fluorescence.

15. The method of Claim 13, wherein said target molecule is selected from the group consisting of: proteins, polypeptides, carbohydrates, lipids, deoxyribonucleic acid, ribonucleic acid and combinations thereof.

16. The method of Claim 13, wherein the difference of matrix material between the secondary gel and primary gel is either the composition of matrix material used and/or percentage or matrix material employed.

17. A diagnostic kit for determining the presence, or absence, of a target molecule in a biological sample comprising:

(i) an electrophoresis gel composition comprising a primary gel comprising a first matrix with a sample loading zone and at least one preformed slot opening for a secondary gel, wherein said slot can have any geometric configuration within the primary gel, and

(ii) optionally one, or more, reagent vials comprising one, or more, second matrices comprising reagents specific for the detection of one, or more, target molecules in a biological sample, wherein these reagents are immobilized to a medium.

18. Diagnostic kit reagents comprising matrix material comprising immobilized probes specific for target molecules.

19. The method of Claim 9, wherein said target molecule is selected from the group consisting of SEQ ID NO. 1.

20. The method of Claim 9, wherein said probe is selected from the group consisting of: SEQ ID NO. 2 and SEQ ID NO. 3.